XXVII. *An Account of a Doubler of Electricity, or a Machine by which the leaſt conceivable Quantity of poſitive or negative Electricity may be continually doubled, till it becomes perceptible by common Electrometers, or viſible in Sparks. By the Rev.* Abraham Bennet, *M. A.; communicated by the Rev.* Richard Kaye, *LL.D. F. R. S.*

Read May 10, 1787.

THE great importance of a machine for the purpoſe of detecting very minute quantities of electricity has occurred to many of the cultivators of this ſcience; as by ſuch an aſſiſtant not only many chemical combinations or ſolutions, but alſo many yet unexplained atmoſpherical phænomena, may become intelligible.

The labours of M. VOLTA have been very ſucceſsful on this ſubject by the application of his condenſer (as he terms it), which, by means of a thin-coated electric, is capable of receiving a greater quantity of the electrical fluid than a common inſulated conductor, and rendering it perceptible by ſeparating the poſitive and negative ſides of the charged plate. On this ingenious contrivance Mr. CAVALLO made a very conſiderable improvement by transferring the received quantity of electricity from a larger to a ſmaller condenſer, as explained in the Phil. Tranſ. Vol. LXXII.

Notwithſtanding the very great ſenſibility of this apparatus, the electricity of the atmoſphere is ſometimes too weak to be diſcoverable by it: for inſtance, in ſome ſhowers, when the negative ſtate of the falling rain is nearly equal to the poſitive ſtate of the air. Add to this the trouble of keeping an inſulated and elevated conductor ſufficiently dry, and the danger

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ger of it in a thunder-ſtorm. I therefore contrived the following doubler for the purpoſe of more eaſily making an electrico-meteorological diary, which I undertook at the requeſt of my friend Dr. DARWIN, who hoped, that from thence ſome lights might be thrown on the cauſes of the ſudden changes of aërial currents, a circumſtance of ſo much importance to the early growth and maturity of vegetation.

I place upon my electrometer, deſcribed in a former Part of the Philoſophical Tranſactions, a circular braſs plate, three or four inches in diameter, poliſhed and thinly varniſhed on the upper ſurface. On this I place another braſs plate, of equal diameter, poliſhed and varniſhed on both ſides, with an inſulating handle attached to one edge of it. A third plate is alſo provided, of equal diameter, poliſhed and varniſhed on the under ſide, and with a perpendicular inſulating handle from the center of the upper ſide, ſimilar to thoſe mentioned in the Appendix to my laſt Paper.

The method of collecting electricity from the atmoſphere, and continually doubling it as much as required, is as follows. If the weather be dry, I carry into the open air a lighted torch, not liable to be eaſily blown out, or a ſmall lantern with a lighted candle in it, to the bottom of which is fixed, by means of a ſocket, an inſulating handle of glaſs covered with ſealing-wax; in the other hand is carried a coated phial: then, elevating the flame a little higher than my head, I apply to it the knob of the phial, holding it in this ſituation about half a minute. Then returning into the houſe (where the above deſcribed doubler is kept dry, by being placed on a table not far from the fire), I apply the knob of the phial to the under ſide of the firſt plate, which lies immediately upon the electrometer, and at the ſame time touching the ſecond plate with a finger of the other hand. Then laying aſide the phial, I lift up the

the ſecond plate by its inſulating handle, and if the electricity be not now ſenſible by the electrometer, I place the third plate, by means of its inſulating handle, upon the ſecond plate, thus elevated: then touching the third plate, by ſtretching a finger over the juncture of its inſulating handle, and again withdrawing the finger, I then again ſeparate the third plate from the ſecond. In this ſituation it will be apparent to electricians that two of the plates are of one kind of electricity, and nearly of equal quantity, and one only of the other. I then apply the third plate to touch the under ſurface of the firſt plate which remains on the electrometer, and at the ſame time covering the firſt plate with the ſecond, I then touch the ſecond plate by ſtretching a finger over the juncture of its inſulating handle; and firſt taking away the third plate, and then withdrawing my finger from the ſecond, and lifting it up from the firſt plate, the electricity becomes doubled. If by this firſt operation the quantity of electricity does not become ſenſible by the electrometer, I repeat the proceſs to ten or twenty times, which, by doubling it every time, makes viſible the ſmalleſt conceivable quantity of electricity, ſince, at the twentieth operation, it is augmented to above 500,000 times. And though in deſcription the above proceſs of doubling to twenty times may appear tedious, yet when the operator can perform it with ſufficient readineſs (which is ſoon acquired) it takes leſs time than 40 ſeconds. The collection of electricity from the air, and the touching and poſition of the plates, are repreſented in Tab. XI. figures 1. 2. 3. 4. 5. and 6.

If it be required to produce ſparks, the plates are to be placed upon an inſulating ſtand, without an electrometer, and the proceſs repeated as above till the ſparks appear.

The experiment which proves that the electricity is doubled by each operation is this. If the two ſlips of pendulous leaf gold of the electrometer be made to diverge to a certain diſtance by the above proceſs, that diſtance will be nearly doubled by repeating the operation. Another proof of this duplicate accumulation is, that, when the third plate is applied to the firſt, the divergency of the leaf gold is apparently undiminiſhed, though in this ſituation their electricity is diffuſed over double the quantity of ſurface.

That flame will collect electricity better than points was mentioned in my former Paper, and is very evident if two phials of equal capacity are expoſed to the air, the one furniſhed with a ſharp point, and the other having its knob applied to an inſulated flame, and their electricity afterwards examined by the doubler.

If the weather be rainy, an inſulated umbrella may be carried in one hand, and the knob of the phial applied to the upper and inſulated part of the handle; and if it rains ſo ſlowly as not ſufficiently to communicate electricity to the umbrella, a torch is carried under the umbrella, and uſed as deſcribed above.

It is obvious that ſome caution is neceſſary in managing experiments of ſo much nicety, ſince, by the leaſt friction of the hand on the varniſhed ſides of the plates or inſulating handles, or if the metallic ſide of one plate be accidentally rubbed againſt the varniſhed ſide of the other, ſome degree of electricity is produced, which, becoming ſenſible by the operation of doubling, may render the experiments equivocal.

To obviate theſe inconveniencies, I join a conducting handle, by means of an inſulating nut, to each of the plates. This handle conſiſts of turned unbaked mahogany, about three inches long, into one end of which is inſerted a nut of baked wood, about half an inch long, covered with ſealing-wax, upon the other end of which nut the braſs ſocket of the plate is fixed; by this means it is not neceſſary to touch the ſealing-

wax

wax of the inſulating nut, but occaſionally to ſtretch a finger over it to touch the plate, whilſt the mahogany handle is held in the ſame hand.

Having found, by repeated experiments, that two clean metallic plates, or two equally varniſhed plates, rubbed together, produced no electricity, I varniſhed the ſecond plate on both ſides, but more thinly than when one ſide only was varniſhed, and in ſome experiments uſed thimbles on the ends of the touching fingers. In this way the inconveniencies of accidental friction were in ſome meaſure obviated, but much leſs than I firſt expected; for, notwithſtanding the utmoſt care, electricity is produced without previous communication: therefore, in experiments requiring the electricity to be often doubled, its communication may yet be aſcertained by applying it to the firſt and ſecond plates alternately; ſo that poſitive electricity communicated to the firſt plate appears poſitive by the electrometer; but the ſame electricity, applied to the ſecond plate whilſt the firſt is touched, produces negative in the electrometer.

I beg leave to add, that this method of doubling either poſitive or negative electricity, as well as M. VOLTA's condenſer, with Mr. CAVALLLO's improvement on it, as alſo the ingenious experiments of Father BECCARIA with double plates of glaſs, which he ſeparated after charging, are all of them to be explained from the ſame principles with the Leyden bottle, of which they may be all ſaid to be only different applications. I ſhall not therefore trouble the Society with any further theory on this ſubject, but proceed to lay before them the diary which I have hitherto kept, and during which time I have found no difficulty in collecting electricity from the atmoſphere poſitive or negative, ſo as to become ſufficiently ſenſible by the above deſcribed apparatus, though the hygrometer has ſometimes ſhewn the greateſt degree of moiſture.

Diary

Dia

Time of obſervation.	Weather.	Winds.	Barometer.	Thermometer.	Hygrometer.	
1787.			In.	°	In.	
Jan. 23. 11 o'clock morning	Cloudy	W. moderate	29.3	44	$0\frac{5}{8}$ M	P
24. $\frac{1}{2}$ paſt 10 morning	Thin clouds	N. moderate	29.44	42	$0\frac{7}{8}$ M	P
25. 11 morning	Thin clouds	E. gentle	29.51	37	$0\frac{3}{8}$ D	P
25. 12 at night	Hard froſt and aurora borealis	E. gentle	29.56	38	$0\frac{6}{8}$ D	P
26. 11 morning	Clear froſt	N. gentle	29.5	38	$0\frac{3}{8}$ D	P
26. $\frac{1}{2}$ paſt 8 at night	Beginning to ſnow	N.E. briſk	29.5	37	$0\frac{3}{8}$ D	P
27. 11 morning	Cloudy and likely to ſnow	N.E. gentle	29.2	35	$0\frac{2}{8}$ D	P
28. 10 morning	Snowing	S.E. ſtrong	28.8	28	$0\frac{2}{8}$ D	N
28. 40 min. paſt 12 noon	Snowing very little	S.E. briſk	28.5	28	$0\frac{1}{8}$ D	P
28. 11 at night.	Fair, but over-caſt	S. gentle	29.06	37	0	P
29. 10 morning	Small rain and miſt on the hills	S. briſk	29.06	38	$3\frac{2}{8}$ M	N
29. $\frac{1}{2}$ paſt 10 morning	Rain ceaſed	D°	29.06	38	$3\frac{6}{8}$ M	P
29. 3 afternoon.	Few drops of rain	S. ſtrong	29.06	41	$5\frac{3}{8}$ M	P
30. 45 min. paſt 10 morning	Fair, but over-caſt	S. ſtrong	29.45	44	$6\frac{5}{8}$ M	P
30. 11 morning	D°	D°	29.44	46	$7\frac{1}{8}$ M	P
31. 10 morning	Fair and clear.	S.W. gentle	29.55	44	$3\frac{2}{8}$ M	P
Feb. 1. 9 morning	Thick miſt with fine drops of rain	Calm	29.53	46	$2\frac{6}{8}$ M	P
1. 11 morning	Thick miſt	S.W. gentle	D°	D°	D°	P
2. 11 morning	Thick miſt	S.W. gentle	29.4	44	$1\frac{3}{8}$ M	P
3. 10 morning	Heavy clouds	S.W. briſk	29.2	46	$3\frac{2}{8}$ M	P
3. $\frac{1}{2}$ paſt 11 morning	Small rain	S.W. ſtrong	D°	D°	D°	N
4. 8 morning	Clear and froſty	Calm	29.3	42	$0\frac{2}{8}$ D	P
5. $\frac{1}{2}$ paſt 10 morning	Thick miſt on the hills	S.E. gentle	29.26	38	$0\frac{3}{8}$ M	P
6. 10 morning	Thick miſt and few drops of rain	S. gentle	29 12	40	1 M	P
7. $\frac{1}{2}$ paſt 10 morning	Cloudy	S.W. briſk	28.7	46	$5\frac{6}{8}$ M	P
7. $\frac{1}{2}$ paſt 2 afternoon	Small rain	S.W. briſk	28.69	47	$4\frac{7}{8}$ M	N
8. $\frac{1}{2}$ paſt nine morning	Clear and froſty	Calm	29.28	40	$0\frac{3}{8}$ M	P
9. 12 noon	Cloudy after rain	S. ſtrong	28.75	46	4 M	P
9. $\frac{1}{2}$ paſt 1 afternoon	Rain	S. ſtrong	28.68	46	$4\frac{5}{8}$ M	N
10. 9 morning	Rain	S. gentle	28.64	44	$1\frac{5}{8}$ M	N
11. 12 noon	Beginning to rain	S. briſk	28.34	42	2 M	N
12. 12 noon	Fair, with heavy clouds	S. ſtrong	27.8	44	$2\frac{2}{8}$ M	P
13. $\frac{1}{2}$ paſt 9 morning	Very ſmall rain, thin clouds	N.W. briſk	28.1	44	$1\frac{2}{8}$ M	N
14. and 15. abſent.						
16. 10 morn.	Small rain	S.W. gentle	28.83	47	$3\frac{1}{8}$ M	N
17. 10 morning.	Very few thin clouds	W. gentle	29.42	44	0	P
18. 1 afternoon	Few white clouds	W. briſk	29 42	48	1 M	P
19. 11 morning	Few diſtant clouds	N.W. gentle	29.53	47	$1\frac{4}{8}$ M	P
20. 11 morning	Over-caſt	N. gentle	29.47	46	$1\frac{4}{8}$ M	P
21. 3 afternoon	Heavy clouds	N. gentle	29.42	47	$1\frac{1}{8}$ M	P
22. 11 morning	Few white clouds	N.E. gentle	29.4	40	$0\frac{6}{8}$ D	P
23. $\frac{1}{2}$ paſt 10 morning	Over-caſt	E. briſk	29.38	40	$1\frac{4}{8}$ D	P
24. 10 morning	Clear and froſty	S.E. gentle	29.32	42	$0\frac{4}{8}$ D	P
25. $\frac{1}{2}$ paſt 12 noon	Few clouds	N.W. ſtrong	29.23	46	1 M	P
26. $\frac{1}{2}$ paſt 10 morning	Clear	S. gentle	29.3	45	$0\frac{2}{8}$ D	P
27. mentioned afterwards						
28. $\frac{1}{2}$ paſt 12 afternoon	Few white clouds	W. ſtrong	29.07	48	0	P
Mar. 1. 2 afternoon	Few drops of rain	S.W. ſtrong	28.68	50	$3\frac{4}{8}$ M	N
2. 10 morning	Small rain.	S.W. very ſtrong	28.35	47	$4\frac{6}{8}$ M	N

N. B. The thermometer and hygrometer were placed where they were not likely to be alte
fixed up three years and upwards, during which time its index has moved

Diary of atmoſpherical Electricity.

ygrometer.	Electricity.	Inſtruments to collect.	Number of times doubled, and other obſervations.
In.			
0$\frac{5}{8}$ M	Poſitive	Torch and bottle	Plate once lifted up.
0$\frac{7}{8}$ M	Poſitive	D°	Ditto.
0$\frac{3}{8}$ D	Poſitive	D°	Ditto.
0$\frac{6}{8}$ D	Poſitive	D°	Ditto, no ſtronger than before.
0$\frac{3}{8}$ D	Poſitive	D°	Ditto; a ſtrong bottle was this day tried, which appeared to collect as well as any.
0$\frac{3}{8}$ D	Poſitive	Umbrella	Doubled.
0$\frac{2}{8}$ D	Poſitive	Torch and bottle	Plate once lifted up.
0$\frac{2}{8}$ D	Negative	Umbrella and torch	Ditto.
0$\frac{1}{8}$ D	Poſitive	Torch and bottle	Doubled.
0	Poſitive	D°	Plate once lifted up; divergency of the leaf gold very great.
3$\frac{2}{8}$ M	Negative	D°	Ditto, but weaker.
3$\frac{6}{8}$ M	Poſitive	D°	Four times doubled.
5$\frac{3}{8}$ M	Poſitive	D°	Plate once lifted up.
0$\frac{5}{8}$ M	Poſitive	D°	Ditto.
7$\frac{1}{8}$ M	Poſitive	D°	Ditto; the hygrometer was higher than known during above three years.
3$\frac{2}{8}$ M	Poſitive	D°	Ditto.
2$\frac{6}{8}$ M	Poſitive	Umbrella and torch	Three times doubled.
D°	Poſitive	Kite	Strong ſparks were produced from a ſtring 260 yards long, with braſs wire in it.
1$\frac{3}{8}$ M	Poſitive	Torch and bottle	Plate once lifted up, very ſtrong.
3$\frac{2}{8}$ M	Poſitive	D°	Ditto, alſo very ſtrong.
D°	Negative	Umbrella	Twice doubled; a few minutes after the torch was tried, when the rain had ceaſed, a
0$\frac{2}{8}$ D	Poſitive	Torch and bottle	Plate once lifted up.
0$\frac{3}{8}$ M	Poſitive	D°	Ditto, ſtrong.
1 M	Poſitive	D°	So ſtrong as twice to ſtrike the ſides of the electrometer, and ſenſible without the pla
5$\frac{6}{8}$ M	Poſitive	D°	Plate once lifted up.
4$\frac{7}{8}$ M	Negative	Umbrella	Ditto.
0$\frac{3}{8}$ M	Poſitive	Torch and bottle	Ditto.
4 M	Poſitive	D°	Ditto.
4$\frac{5}{8}$ M	Negative	Umbrella	Ditto.
1$\frac{5}{8}$ M	Negative	Umbrella	Ditto.
2 M	Negative	Torch and bottle	Ditto.
2$\frac{2}{8}$ M	Poſitive	D°	Ditto.
1$\frac{2}{8}$ M	Negative	D°	Ditto; 10 minutes after the rain ceaſed the electrometer was weakly negative, and 5
3$\frac{1}{8}$ M	Negative	D°	Ditto.
0	Poſitive	D°	Ditto.
1 M	Poſitive	D°	Ditto.
1$\frac{4}{8}$ M	Poſitive	D°	Ditto.
1$\frac{4}{8}$ M	Poſitive	D°	Ditto.
1$\frac{1}{8}$ M	Poſitive	D°	Ditto.
0$\frac{6}{8}$ D	Poſitive	D°	Ditto.
1$\frac{4}{8}$ D	Poſitive	D°	Ditto.
0$\frac{4}{8}$ D	Poſitive	D°	Ditto.
1 M	Poſitive	Lantern	Juſt ſenſible to the electrometer, without the doubler.
0$\frac{2}{8}$ D	Poſitive	Lantern	More ſenſible, the lantern being elevated fifteen feet high.
0	Poſitive	Lantern and bottle	Four times doubled.
3$\frac{4}{8}$ M	Negative	Umbrella	Often doubled; a few minutes after rain ceaſed, and the electrometer became poſitiv
4$\frac{6}{8}$ M	Negative	Umbrella and torch	Plate once lifted up.

be altered by accidental heat. The hygrometer conſiſted of fifteen feet of whipcord, ſuſpen
moved within the ſpace of 14 inches, which is therefore divided into inches and eighths, mo

tions.

as any.

in it.

ceaſed, and a much ſtronger poſitive was produced.

at the plates.

e, and 5 minutes after that ſtrongly poſitive.

ne poſitive.

ſuſpended horizontally: it has been
ıs, moiſt and dry.

The atmoſpherical electricity was ſometimes ſo ſtrong as to need no doubling, and moſtly required only one application of the ſecond plate, yet I frequently found it neceſſary to repeat the proceſs from two or three to twenty times. Perhaps the exact comparative quantity of electricity reſiding in the atmoſphere might be meaſured by the number of operations required to render it perceptible by the electrometer, all other circumſtances being cautiouſly attended to.

If the electricity of the atmoſphere ſhould happen to be much weaker than I have yet found it, there remains not only the reſource of doubling oftener, but the capacity of the inſtruments may be much increaſed; as, firſt, by uſing a larger flame; ſecondly, by elevating it higher; thirdly, by collecting the electricity with a very thin glaſs ball, ſilvered within, and coated on the outſide in the common way, or gilt; fourthly, by grinding and poliſhing the plates of the doubler very exactly; fifthly, by making the experiments in an advantageous ſituation. In all theſe particulars my apparatus was defective, yet amply ſufficient for the diſcovery of the atmoſpherical electricity.

After conſidering the ſucceſsful effect of flame, in collecting atmoſpherical electricity, I placed an inſulated lantern upon a pole about fifteen feet high, and ſuſpending a gold thread from the lantern connected it with the electrometer, and was agreeably amuſed with ſeeing the pendulous gold leaf open and ſhut with every paſſing cloud.

On the 27th of February, 1787, when there was a conſiderable miſt whilſt the lantern was thus elevated, the leaf gold frequently ſtruck the ſides of the electrometer; and, in about an hour, ſome drops of rain beginning to fall, the appearance of electricity with this apparatus entirely ceaſed, though I elevated the lantern ſeveral times in the courſe of the day.

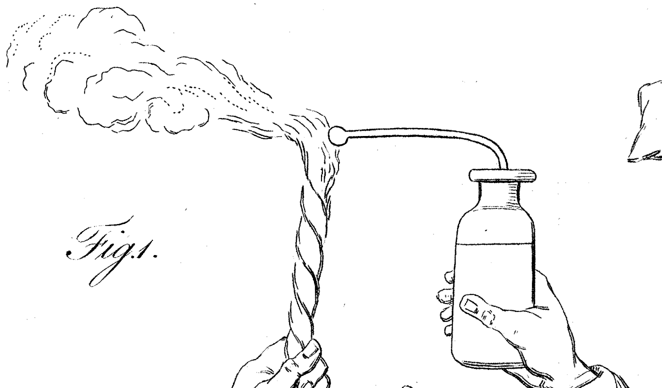

Fig. 1.

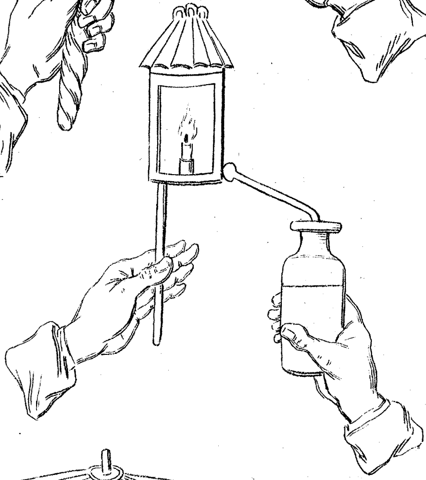

Fig. 2.

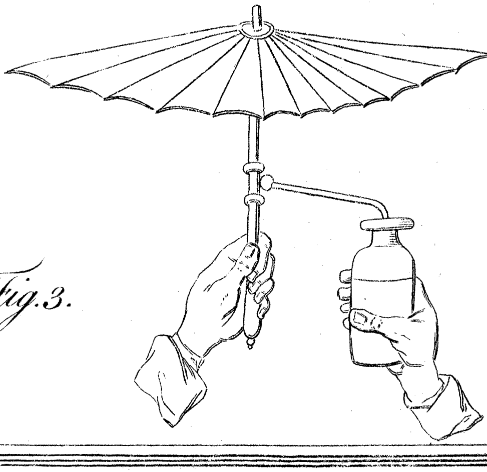

Fig. 3.

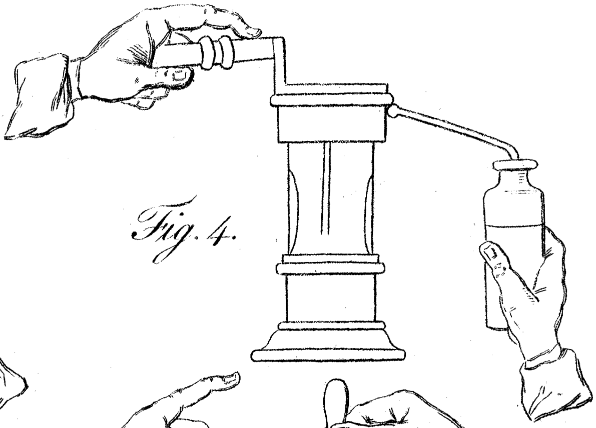

Fig. 4.

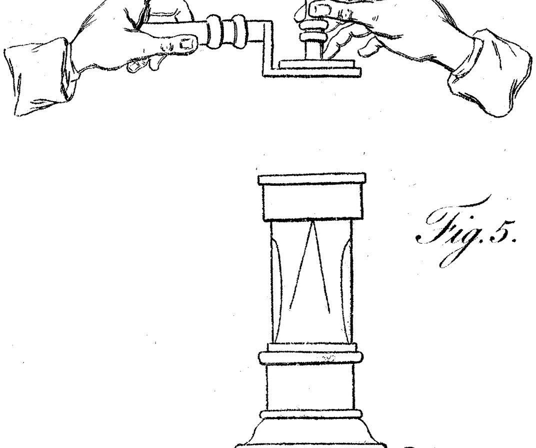

Fig. 5.

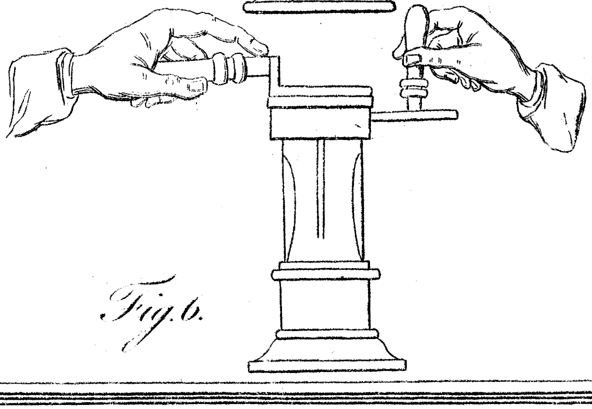

Fig. 6.

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Diary of atmoſpherical Electricity.

Time of obſervation.	Weather.	Winds.	Baro-meter.	Thermo-meter.	Hygro-meter.	Electri-city.	Inſtruments to collect.	Number of times doubled, and other obſervations.
1787.			In.	°	In.			
Jan. 23. 11 o'clock morning	Cloudy	W. moderate	29.3	44	0⅜ M	Poſitive	Torch and bottle	Plate once lifted up.
24. ½ paſt 10 morning	Thin clouds	N. moderate	29.44	42	0⅛ M	Poſitive	D°	Ditto.
25. 11 morning	Thin clouds	E. gentle	29.51	37	0⅝ D	Poſitive	D°	Ditto.
25. 12 at night	Hard froſt and aurora borealis	E. gentle	29.50	38	0⅝ D	Poſitive	D°	Ditto, no ſtronger than before.
26. 11 morning	Clear froſt	N. gentle	29.5	38	0⅝ D	Poſitive	D°	Ditto; a ſtrong bottle was this day tried, which appeared to collect as well as any.
26. ½ paſt 8 at night	Beginning to ſnow	N.E. briſk	29.5	37	0⅝ D	Poſitive	Umbrella	Doubled.
27. 11 morning	Cloudy and likely to ſnow	N.E. gentle	29.2	35	0⅜ D	Poſitive	Torch and bottle	Plate once lifted up.
28. 10 morning	Snowing	S.E. ſtrong	28.8	28	0⅜ D	Negative	Umbrella and torch	Ditto.
28. 40 min. paſt 12 noon	Snowing very little	S.E. briſk	28.5	28	0⅛ D	Poſitive	Torch and bottle	Doubled.
28. 11 at night.	Fair, but over-caſt	S. gentle	29.06	37	0	Poſitive	D°	Plate once lifted up; divergency of the leaf gold very great.
29. 10 morning	Small rain and miſt on the hills	S. briſk	29.06	38	3⅛ M	Negative	D°	Ditto, but weaker.
29. ½ paſt 10 morning	Rain ceaſed	D°	29.06	38	3⅝ M	Poſitive	D°	Four times doubled.
29. 3 afternoon.	Few drops of rain	S. ſtrong	29.06	41	5⅛ M	Poſitive	D°	Plate once lifted up.
30. 45 min. paſt 10 morning	Fair, but over-caſt	S. ſtrong	29.45	44	6⅛ M	Poſitive	D°	Ditto.
30. 11 morning	D°	D°	29.44	46	7⅛ M	Poſitive	D°	Ditto; the hygrometer was higher than known during above three years.
31. 10 morning	Fair and clear.	S.W. gentle	29.55	44	3⅛ M	Poſitive	D°	Ditto.
Feb. 1. 9 morning	Thick miſt with fine drops of rain	Calm	29.53	46	2⅝ M	Poſitive	Umbrella and torch	Three times doubled.
1. 11 morning	Thick miſt	S.W. gentle	D°	D°	D°	Poſitive	Kite	Strong ſparks were produced from a ſtring 260 yards long, with braſs wire in it.
2. 11 morning	Thick miſt	S.W. gentle	29.4	44	1⅛ M	Poſitive	Torch and bottle	Plate once lifted up, very ſtrong.
3. 10 morning	Heavy clouds	S.W. briſk	29.2	46	3⅛ M	Poſitive	D°	Ditto, alſo very ſtrong.
3. ½ paſt 11 morning	Small rain	S.W. ſtrong	D°	D°	D°	Negative	Umbrella	Twice doubled; a few minutes after the torch was tried, when the rain had ceaſed, and a much ſtronger poſitive was produced.
4. 8 morning	Clear and froſty	Calm	29.3	42	0⅛ D	Poſitive	Torch and bottle	Plate once lifted up.
5. ½ paſt 10 morning	Thick miſt on the hills	S.E. gentle	29.26	38	0⅜ M	Poſitive	D°	Ditto, ſtrong.
6. 10 morning	Thick miſt and few drops of rain	S. gentle	29 12	40	1 M	Poſitive	D°	So ſtrong as twice to ſtrike the ſides of the electrometer, and ſenſible without the plates.
7. ½ paſt 10 morning	Cloudy	S.W. briſk	28.7	46	5⅝ M	Poſitive	D°	Plate once lifted up.
7. ½ paſt 2 afternoon	Small rain	S.W. briſk	28.69	47	4⅝ M	Negative	Umbrella	Ditto.
8. ½ paſt nine morning	Clear and froſty	Calm	29.28	40	0⅜ M	Poſitive	Torch and bottle	Ditto.
9. 12 noon	Cloudy after rain	S. ſtrong	28.75	46	4 M	Poſitive	D°	Ditto.
9. ½ paſt 1 afternoon	Rain	S. ſtrong	28.68	46	4⅝ M	Negative	Umbrella	Ditto.
10. 9 morning	Rain	S. gentle	28.64	44	1⅝ M	Negative	Umbrella	Ditto.
11. 12 noon	Beginning to rain	S. briſk	28.34	42	2 M	Negative	Torch and bottle	Ditto.
12. 12 noon	Fair, with heavy clouds	S. ſtrong	27.8	44	2⅛ M	Poſitive	D°	Ditto.
13. ½ paſt 9 morning	Very ſmall rain, thin clouds	N.W. briſk	28.1	44	1⅜ M	Negative	D°	Ditto; 10 minutes after the rain ceaſed the electrometer was weakly negative, and 5 minutes after that ſtrongly poſitive.
14. and 15. abſent.								
16. 10 morn.	Small rain	S.W. gentle	28.83	47	3⅝ M	Negative	D°	Ditto.
17. 10 morning.	Very few thin clouds	W. gentle	29.42	44	0	Poſitive	D°	Ditto.
18. 1 afternoon	Few white clouds	W. briſk	29 42	48	1 M	Poſitive	D°	Ditto.
19. 11 morning	Few diſtant clouds	N.W. gentle	29.53	47	1⅜ M	Poſitive	D°	Ditto.
20. 11 morning	Over-caſt	N. gentle	29.47	46	1⅜ M	Poſitive	D°	Ditto.
21. 3 afternoon	Heavy clouds	N. gentle	29.42	47	1⅛ M	Poſitive	D°	Ditto.
22. 11 morning	Few white clouds	N.E. gentle	29.4	40	0⅝ D	Poſitive	D°	Ditto.
23. ½ paſt 10 morning	Over-caſt	E. briſk	29.38	40	1⅜ D	Poſitive	D°	Ditto.
24. 10 morning	Clear and froſty	S.E. gentle	29.32	42	0⅜ D	Poſitive	D°	Ditto.
25. ½ paſt 12 noon	Few clouds	N.W. ſtrong	29 23	46	1 M	Poſitive	Lantern	Juſt ſenſible to the electrometer, without the doubler.
26. ½ paſt 10 morning	Clear	S. gentle	29.3	45	0⅝ D	Poſitive	Lantern	More ſenſible, the lantern being elevated fifteen feet high.
27. mentioned afterwards								
28. ½ paſt 12 afternoon	Few white clouds	W. ſtrong	29.07	48	0	Poſitive	Lantern and bottle	Four times doubled.
Mar. 1. 2 afternoon	Few drops of rain	S.W. ſtrong	28.68	50	3⅛ M	Negative	Umbrella	Often doubled; a few minutes after rain ceaſed, and the electrometer became poſitive.
2. 10 morning	Small rain.	S.W. very ſtrong	28.35	47	4⅝ M	Negative	Umbrella and torch	Plate once lifted up.

N. B. The thermometer and hygrometer were placed where they were not likely to be altered by accidental heat. The hygrometer conſiſted of fifteen feet of whipcord, ſuſpended horizontally: it has been fixed up three years and upwards, during which time its index has moved within the ſpace of 14 inches, which is therefore divided into inches and eighths, moiſt and dry.